

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT WE, Satoshi Iwata, a citizen of Japan residing at Kawasaki, Japan and Shoji Suzuki, a citizen of Japan residing at Kawasaki, Japan have invented certain new and useful improvements in

DISPLAY SYSTEM, DISPLAY CONTROL METHOD AND COMPUTER
READABLE MEDIUM STORING DISPLAY CONTROL PROGRAM CODE

of which the following is a specification : -

TITLE OF THE INVENTION

DISPLAY SYSTEM, DISPLAY CONTROL METHOD AND
COMPUTER READABLE MEDIUM STORING DISPLAY
CONTROL PROGRAM CODE

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BACKGROUND OF THE INVENTION

1. Field of The Invention

The present invention relates to a portable display system in which document data, such as electronic document or electronic magazine, is displayed on a display unit. The present invention relates to a display control method that controls the display system. Further, the present invention relates to a computer readable medium that stores display control program code instructions for use in the display system.

15 2. Description of The Related Art

A portable display system in which a document data, including characters and images, is displayed on a display unit, such as a liquid crystal display, is known. The proliferation of such portable display systems is increasing with development of a large-size liquid-crystal display and reduction of the cost. By using a portable display system, the user can easily display and view the information of electronic documents or electronic magazines, on the screen of the display unit.

For example, the electronic document format and the EPWing format are commonly used when displaying a text-based electronic document on the display unit. When displaying text data in the electronic document format, the frame of a viewer software package, which is configured to be analogous with a book, appears on the screen of the display unit. The original text data is converted into a processed document data using preset character fonts of the viewer software, and the processed document data is displayed. The electronic document format is primarily used when displaying text-based electronic documents. The EPWing format is similar to the electronic document format. When displaying text data in the EPWing format, the frame of a viewer software package appears on the screen of the display unit. The viewer software package is provided with a search engine. A desired part of electronic

document is searched from the original text data, and the obtained part is converted into a processed document data, and the processed document data is displayed. The EPWing format is primarily used when displaying text-based electronic dictionaries.

5 On the other hand, when displaying a document data in which characters and images, such as drawings or illustrations, coexist, the PDF (portable document format) is frequently used. The PDF is a well-known file format for creating and viewing documents, which is originally developed to standardize Internet-based
10 documents. The PDF file format includes the document data with data elements arranged according to a page layout. The document data with the page layout is visualized on the display unit. The PDF is primarily used when displaying text/image-mixed electronic magazines, including the document design, the page layout and the
15 image data, on the screen of the display unit.

 However, when an electronic document or electronic magazine is displayed using a portable display system, the screen of the display unit in the portable display system is too small in size to clearly view the details of the electronic document. When
20 the entire document data with the original display size is selected on the portable display system, it is often difficult for the user to view the fine characters in the document data on the display unit.

 Further, when an enlarged view of the document data is selected on the portable display system, the entire document data is
25 enlarged on the display unit. In order to find out a desired part of the document data, it is necessary for the user to shift or scroll the enlarged view on the display unit by additionally manipulating the display system, which will be detrimental to the portability of the display system. In addition, when the enlarged view of the
30 document data is displayed on the screen of the display unit, the entire document data with the original display size does not appear simultaneously with the enlarged view, which lowers the document displaying capabilities of the display system.

35 SUMMARY OF THE INVENTION

 Accordingly, it is an object of the present invention to provide an improved display system in which the above-described

problems are eliminated.

Another object of the present invention is to provide a display system in which the document displaying capabilities and the portability are improved.

5 Another object of the present invention is to provide a method of controlling a display system, in which the document displaying capabilities and the portability are improved.

Another object of the present invention is to provide a storage medium storing program code instructions to cause the
10 computer to control a display system, in which the document displaying capabilities and the portability are improved.

The above-mentioned objects of the present invention are achieved by a display system in which a document data is displayed on a display unit, the display system including: a display
15 specification detection unit which detects a display specification data, the display specification data representing specifications of the display unit; a layout data detection unit which detects a layout data of the document data, the layout data being integrally stored with the document data and representing a page layout of data
20 elements of the document data that are displayed; and a display control unit which controls the display unit such that the document data is displayed on the display unit in conformity with the detected display specification data and the detected layout data.

The above-mentioned objects of the present invention are
25 achieved by a method of controlling a display system in which a document data is displayed on a display unit, the method including the steps of: detecting a display specification data, the display specification data representing specifications of the display unit; detecting a layout data of the document data, the layout data being
30 integrally stored with the document data and representing a page layout of data elements of the document data that are displayed; and controlling the display unit such that the document data is displayed on the display unit in conformity with the detected display specification data and the detected layout data.

35 The above-mentioned objects of the present invention are achieved by a computer readable medium storing program code for causing a processor to control a display system in which a

document data is displayed on a display unit, the computer readable medium including: a first program code unit that causes the processor to detect a display specification data, the display specification data representing specifications of the display unit; a
5 second program code unit that causes the processor to detect a layout data of the document data, the layout data being integrally stored with the document data and representing a page layout of data elements of the document data being displayed; and a third
10 program code unit that causes the processor to control the display unit such that the document data is displayed on the display unit in conformity with the detected display specification data and the detected layout data.

In the display system and the display control method according to the present invention, the page layout processing is
15 carried out for the data elements of the document data by a CPU such that the data elements are allocated on the screen of the display unit in conformity with the layout data that is detected from the document data. Therefore, the display system and the display control method of the present invention are effective in improving
20 the document displaying capabilities and the portability.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features and advantages of the present invention will become apparent from the following detailed
25 description when read in conjunction with the accompanying drawings.

FIG. 1 is a block diagram of a display system to which a first preferred embodiment of the invention is applied.

FIG. 2 is a diagram for explaining the details of a document
30 data in the first preferred embodiment.

FIG. 3 is a diagram showing an example of the document data and the display format in the first preferred embodiment.

FIG. 4 is a flowchart for explaining a display size processing routine executed by a second preferred embodiment of the display
35 system of the invention.

FIG. 5 is a diagram for explaining the display size processing routine of the second preferred embodiment.

FIG. 6 is a block diagram of a display system to which a third preferred embodiment of the invention is applied.

FIG. 7 is a diagram for explaining a display screen switching of the display system of the third preferred embodiment.

5 FIG. 8 is a diagram for explaining another display screen switching of the display system of the third preferred embodiment.

FIG. 9 is a diagram for explaining another display screen switching of the display system of the third preferred embodiment.

10 FIG. 10 is a flowchart for explaining a display format processing routine executed by a fourth preferred embodiment of the display system of the invention.

FIG. 11 is a flowchart for explaining another display format processing routine executed by the display system of the fourth preferred embodiment.

15 FIG. 12 is a flowchart for explaining another display format processing routine executed by the display system of the fourth preferred embodiment.

20 FIG. 13 is a diagram for explaining a display screen switching of a fifth preferred embodiment of the display system of the invention.

FIG. 14 is a flowchart for explaining a text data paragraph setting routine executed by a sixth preferred embodiment of the display system of the invention.

25 FIG. 15 is a diagram for explaining the text data paragraph setting routine of the sixth preferred embodiment.

FIG. 16 is a diagram for explaining a data element layer display control processing of a seventh preferred embodiment of the display system of the invention.

30 FIG. 17 is a diagram for explaining another data element layer display control processing of the display system of the seventh preferred embodiment.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

35 A description will now be provided of the preferred embodiments of the present invention with reference to the accompanying drawings.

FIG. 1 shows a display system 100 to which a first preferred

embodiment of the invention is applied.

As shown in FIG. 1, the display system 100 generally includes a display device 10, a storage device 13, a document data source 14, an interface (I/F) 15, a CPU (central processing unit) 16, and an operation unit 17. In the display device 10, a display unit 11 and a display memory 12 are provided, and they are connected together. The CPU 16 supplies a processed document data to the display memory 12 in the display device 10. The processed document data is stored in the display memory 12, and the document data is displayed or visualized on the display unit 11.

The CPU 16 creates a processed document data that is supplied to the display device 10. An original document data is produced at the document data source 14 through a DTP (desktop publishing) technique. The CPU 16 receives the original document data from the document data source 14 via the interface 15. A display specification data, including a display screen size and a display resolution related to the display unit 11, is stored in the storage device 13. The CPU 16 produces a processed document data from the original document data in conformity with the display specification data stored in the storage device 13. The processed document data produced by the CPU 16 is stored in the storage device 13. The processed document data that is stored in the storage device 13 is comprised of a layout data, text data elements, and image data elements, which will be described later. When displaying the document data, the CPU 16 receives the processed document data from the storage device 13, and supplies the processed document data to the display memory 12 in the display device 10. The user is allowed to input, from the operation unit 17, a request for changing the display specification data related to the display unit 11, to the CPU 16. In response to the request, the CPU 16 performs a display specification changing procedure in which the display specification data stored in the storage device 13 is changed accordingly.

As described above, in the display system 100 of FIG. 1, the CPU 16 produces a processed document data from the original document data in conformity with the display specification data stored in the storage device 13. The processed document data

produced by the CPU 16 is stored in the storage device 13. When displaying the document data, the CPU 16 receives the processed document data from the storage device 13, and supplies the processed document data to the display memory 12 in the display device 10, so that the document data is displayed on the display unit 11 in conformity with the display specification data and the layout data.

FIG. 2 shows the details of a document data in the first preferred embodiment. As shown in FIG. 2, the document data is comprised of a layout data (L/D), text data elements (T/D), and image data elements (I/D). In the display system of the present embodiment, the layout data is stored in the storage device 13 integrally with the document data. The layout data contains layout information of the document data, and this layout information is provided when the original document data is produced through the DTP technique at the document data source 14. The layout information is comprised of data element identifiers, data element positions, and page format data of the respective data elements contained in the document data. The layout of the data elements of the document data on the display screen of the display unit 11 is set by the layout information.

The text data elements, contained in the document data, are comprised of a font size, a font type, a character color, and a character pitch. The details of the text data, displayed on the display unit 11, are set in accordance with these data elements. The image data elements, contained in the document data, are comprised of an image file type and an image size. The details of the image data, displayed on the display unit 11, are set in accordance with these data elements. In the display system of the present embodiment, the document data is displayed on the display unit 11 in accordance with these data elements, regardless of the device type or the internal setting of the display unit 11.

FIG. 3 shows an example of the document data and the display format in the first preferred embodiment of the display system. As shown in FIG. 3, the document data of this example is aimed at a printed material in which text data and image data coexist. When printing the document data of this example, a layout

data, a text data "A", a text data "B", a text data "C", an image data "a" and an image data "b" are printed on paper in this order. The display format of the document data that corresponds to the printing format is also shown in FIG. 3. When the document data of this example is displayed on the display unit 11, the text data "A" is allocated at the top of the left column, the text data "B" is allocated at the top of the right column, the text data "C" is allocated in the middle of the right column, the image data "a" is allocated at the bottom of the left column, and the image data "b" is allocated at the bottom of the right column.

In the display system and the display control method of the above-described embodiment, the page layout processing is carried out for the text/image data elements of the document data by the CPU 16 such that the text/image data elements are allocated on the screen of the display unit 11 in conformity with the layout data that is detected from the document data. Hence, the display system and the display control method of the present embodiment are effective in improving the document displaying capabilities and the portability.

FIG. 4 is a flowchart for explaining a display size processing routine of a second preferred embodiment of the display system of the invention.

In the present embodiment, the elements of the display system are essentially the same as the corresponding elements of the display system shown in FIG. 1, and a description thereof will be omitted. The display size processing routine of FIG. 4 is constituted by program code instructions stored in a memory of the CPU 16 or the storage device 13. In the present embodiment, the memory of the CPU 16 or the storage device 13 corresponds to the computer readable medium in the claims. Alternatively, other types of computer usable devices and media may be used as the computer readable medium in the claims. Further, in the display system of the present embodiment, the program code instructions, stored in the memory of the CPU 16 or the storage device 13 (the computer readable medium), cause the CPU 16 to execute the display size processing routine of FIG. 4.

As shown in FIG. 4, at a start of the display size processing

routine, the CPU 16 at step S11 inputs an original document data that is received from the document data source 14. After the document data is inputted, the CPU 16 at step S12 detects the layout data from the document data. After the layout data is
5 detected, the CPU 16 at step S13 identifies the text/image data elements of the document data. After the text/image data elements are identified, the CPU 16 at step S14 detects the display specification data that is stored in the storage device 13.

The CPU 16 at step S15 calculates a display size that is
10 appropriate for the text data elements to be readable on the screen of the display unit 11, based on the detected display specification data (step S14) and the detected layout data (step S13). For example, when displaying an A4-size document (electronic magazine) on a portable display system having the specifications of
15 180-dpi resolution and 8-inch size, it is necessary to enlarge the original display size to a display size that is appropriate to make the document data, displayed on the display unit 11, readable to the user. In such a case, if the document data is displayed with the original display size (no enlargement), the displayed document with
20 the original display size will be less readable to the user. To eliminate this problem, the CPU 16 at step S15 calculates the appropriate display size based on the detected display specification data and the detected layout data.

After the step S15 is performed, the CPU 16 at step S16
25 produces a processed document data that reflects the display size calculated at the step S15, and stores the resulting document data into the storage device 13. Further, in the step S16, the CPU 16 receives the processed document data from the storage device 13, and supplies the processed document data to the display memory 12
30 in the display device 10, so that the document data is displayed on the display unit 11 in conformity with the display specification data and the layout data.

FIG. 5 is a diagram for explaining the display size processing routine of the present embodiment. As shown in FIG. 5, in the
35 steps S11 through S13 of the routine of FIG. 4, the CPU 16 detects the layout data from the document data, and identifies the respective text/image data elements of the document data from the

detected layout data. Suppose that, in the example of FIG. 5, the document data includes the text data elements "A" through "C" and the image data elements "a" and "c". In the step S13, the CPU 16 separates the image data elements "a" and "c" from the text data elements "A" through "C". In the present embodiment, the CPU 16 takes no action for the image data elements "a" and "c".

Suppose that, in the example of FIG. 5, the text data element "A" is selected by the user from among the text data elements "A" through "C". With respect to the selected one of the text data elements "A" through "C", the CPU 16 performs the steps S14 and S15. The CPU 16 at the step S14 detects the display specification data that is stored in the storage device 13. The display specification data detected at the step S14 includes a display screen size and a display resolution related to the display unit 11. The CPU 16 at the step S15 calculates a display size that is appropriate for the text data element "A" to be readable on the screen of the display unit 11, based on the detected display specification data and the detected layout data.

After the calculation of the display size at the step S15 is performed, the CPU 16 at the step S16 controls the display device 10 so that the text data element "A" is displayed on the display unit 11 in conformity with the display size calculated at the step S15. In the example of FIG. 5, the original display size is enlarged, as shown, to the appropriate display size that is calculated at the step S15.

In the display system of the above-described embodiment, when the user selects a desired one of the text data elements of the document data for displaying, it is possible to provide an enlarged view of the selected data element on the display unit 11 for increasing the readability of the displayed document to the user. Hence, the display system of the present embodiment is effective in improving the document displaying capabilities and the portability.

In the display system of the above-described embodiment, the user is allowed to input, from the operation unit 17, a request for changing the display specification data related to the display unit 11, to the CPU 16. In response to the request, the CPU 16 performs a display specification changing procedure in which the display

specification data stored in the storage device 13 is changed accordingly. For example, the display specification data may be modified so as to include a display resolution or a display screen size of the display unit 12 of the user's desired type. Hence, the display system of the present embodiment is effective in improving the document displaying capabilities and the portability.

Next, FIG. 6 shows a display system 101 to which a third preferred embodiment of the invention is applied.

As shown in FIG. 6, the display system 101 generally includes a display device 20, a storage device 23, a document data source 24, an interface (I/F) 25, a CPU (central processing unit) 26, and an operation unit 27. In the display device 20, a display unit 21 and a display memory 22 are provided, and they are connected together.

In the display system 101 of the present embodiment, the storage device 23 supplies an original document data (which is called the display-method1 document data) to the display memory 22. The CPU 26 supplies a processed document data (which is called the display-method2 document data) to the display memory 22. Both the display-method1 document data and the display-method2 document data are stored in the display memory 22, and switching between the display method1 and the display method2 is possible. A selected document data (one of the display-method1 document data and the display-method2 document data) is displayed on the display unit 21 according to the user's demand. The user is allowed to input, from the operation unit 27, the demand for selection of the document data to the CPU 26.

Similar to the embodiment of FIG. 1, in the present embodiment, a display specification data, including a display screen size and a display resolution related to the display unit 21, is stored in the storage device 23. The user is allowed to input, from the operation unit 27, a request for changing the display specification data related to the display unit 21, to the CPU 26. In response to the request, the CPU 26 performs a display specification changing procedure in which the display specification data stored in the storage device 23 is changed accordingly.

In the display system 101 of the present embodiment, an

original document data is produced at the document data source 24 through the DTP technique. The CPU 26 receives the original document data from the document data source 24 via the interface 25, and supplies the original document data to the storage device 23, so that the original document data is temporarily stored in the storage device 23 as the display-method1 document data. When the display method1 is selected according to the user's demand, the CPU 26 controls the display device 20 so that the display-method1 document data is displayed on the display unit 21, with the original size, in conformity with the display specification data stored in the storage device 23.

Similar to the embodiment of FIG. 4, the CPU 26 in the present embodiment produces a processed document data from the original document data in conformity with the display specification data stored in the storage device 23 and the layout data contained in the document data. A particular one of the text data elements of the original document data is selected by the user. The calculation of the display size, which is similar to the step S15 of the routine of FIG. 4, is performed for the selected data element. The thus processed document data produced by the CPU 26 is supplied to the storage device 23 so that the processed document data (the display-method2 document data) is temporarily stored in the storage device 23 as the display-method2 document data. When the display method2 is selected according to the user's demand, the CPU 26 receives the processed document data from the storage device 23, and supplies the processed document data to the display memory 22 in the display device 20. The CPU 26 controls the display device 20 so that the selected data element (the display-method2 document data) is displayed on the display unit 21 in conformity with the display size calculated.

As described above, in the display system 101 of FIG. 6, the user is allowed to input, from the operation unit 27, a demand for selection of the document data to the CPU 26. The CPU 26 selects one of the display-method1 document data and the display-method2 document data in response to the user input, and controls the display device 20 so that the selected one of the display-method1 document data and the display-method2 document data is displayed

on the display unit 21. Therefore, the display system and the display control method of the present embodiment are effective in improving the document displaying capabilities.

FIG. 7 is a diagram for explaining a display screen switching of the display system 101 of the third preferred embodiment. As shown in FIG. 7, in a display example on the left side, the original document data with an original display size (with no enlargement/reduction) is displayed on the display unit 21, which is according to the display method1. In a display example on the right side of FIG. 7, one of the text data elements "A", "B" and "C" of the document data is selected according to the user's demand, and the CPU 26 controls the display unit 21 such that the selected text data element "A" is displayed with a calculated display size (or the enlarged view) on the display unit 21, which is according to the display method2.

In the present embodiment, the user is allowed to input, from the operation unit 27, a demand for selection of the document data to the CPU 26. In the display system 101 of the present embodiment, the switching between the display-method1 document data and the display-method2 document data is possible for the displaying of the selected document data on the screen of the display unit 21. The display system and the display control method of the present embodiment are appropriate for displaying electronic documents or images described by XML (extensible markup language) or other markup languages, on the screen of the display unit 21.

FIG. 8 is a diagram for explaining another display screen switching of the display system 101 of the third preferred embodiment. As shown in FIG. 8, in a display example on the left side, the entire document data with a calculated display size (or the reduced view) is displayed on the display unit 21, which is according to the display method1. In a display example on the right side of FIG. 8, one of the text data elements "A", "B" and "C" of the document data is selected according to the user's demand, and the CPU 26 controls the display unit 21 such that the selected text data element "A" is displayed with a calculated display size (or the enlarged view) on the display unit 21, which is according to

the display method2.

In the present embodiment, the user is allowed to input, from the operation unit 27, a demand for selection of the document data to the CPU 26. In the display system 101 of the present
5 embodiment, the switching between the display-method1 document data and the display-method2 document data is possible for the displaying of the selected document data on the screen of the display unit 21. The display system and the display control method of the present embodiment are appropriate for displaying electronic
10 documents or images in the PDF format or the like, on the screen of the display unit 21.

FIG. 9 is a diagram for explaining another display screen switching of the display system 101 of the third preferred embodiment. As shown in FIG. 9, in a display example on the left
15 side, the entire document data with a calculated display size (or the reduced view) is displayed on the display unit 21, which is according to the display method1. In a display example on the right side of FIG. 9, one of the text data elements "A", "B" and "C" of the document data is selected according to the user's demand,
20 and the CPU 26 controls the display unit 21 such that an image of the selected text data element "A", which is overlapped over a background image of the entire document data with the calculated display size (or the reduced view), is displayed with the calculated display size (or the enlarged view) on the display unit 21, which is
25 according to the display method2.

In the present embodiment, the user is allowed to input, from the operation unit 27, a demand for selection of the document data to the CPU 26. In the display system 101 of the present
30 embodiment, the switching between the display-method1 document data and the display-method2 document data is possible for the displaying of the selected document data on the screen of the display unit 21. The display system and the display control method of the present embodiment are appropriate for displaying electronic documents or images in the PDF format or the like, on
35 the screen of the display unit 21.

FIG. 10 is a flowchart for explaining a display format processing routine executed by a fourth preferred embodiment of

the display system of the invention.

In the present embodiment, the elements of the display system are essentially the same as the corresponding elements of the display system 101 shown in FIG. 6, and a description thereof will be omitted. The display format processing routine of one of FIG. 10, FIG. 11 and FIG. 12 is constituted by program code instructions stored in a memory of the CPU 26 or the storage device 23. In the present embodiment, the memory of the CPU 26 or the storage device 23 corresponds to a computer readable medium. Alternatively, other types of computer usable devices and media may be used as a computer readable medium. Further, in the display system 101 of the present embodiment, the program code instructions, stored in the memory of the CPU 26 or the storage device 23 (the computer readable medium), cause the CPU 26 to execute the display format processing routine of one of FIG. 10, FIG. 11 and FIG. 12.

As shown in FIG. 10, at a start of the display format processing routine, the CPU 26 at step S21 inputs an original document data that is received from the document data source 24. After the document data is inputted, the CPU 26 at step S22 detects the layout data from the document data. After the layout data is detected, the CPU 26 at step S23 identifies the text/image data elements through classification of the document data. After the text/image data elements are identified, the CPU 26 at step S24 detects the display specification data that is stored in the storage device 23.

The CPU 26 at step S25 reads out a maximum display resolution from the display specification data detected at the step S24. After the maximum display resolution is read out, the CPU at step S26 reads out a document font data from the text data elements obtained at the step S23. In the present embodiment, a font size list including an optimum font size of a displayed text data for the maximum display resolution of the display unit 21 is created based on the maximum display resolution (obtained at the step S25) and the document font data (obtained at the step S26). The CPU 26 at step S27 calculates a font size of the displayed text data by using the font size list. In the step S27, it is necessary for the user to

preset a desired font type of the font size list in the calculation of an appropriate font size of the displayed text data.

5 After the font size of the displayed text data is calculated, the CPU 26 at step S28 calculates a display size that is appropriate for the text data elements to be readable on the screen of the display unit 21, based on the calculated font size (step S27). After the step S28 is performed, the CPU 26 at step S29 produces a processed document data that reflects the display size calculated at the step S28, and stores the resulting document data into the storage device 23. Further, in the step S29, the CPU 26 receives the processed document data from the storage device 23, and supplies the processed document data to the display memory 22 in the display device 20, so that the document data is displayed on the display unit 21 in conformity with the display specification data and the layout data.

The display system of the above-described embodiment can provide the user with an appropriate font size of the displayed text data when viewing the document data displayed on the screen of the display unit 21.

20 FIG. 11 is a flowchart for explaining another display format processing routine executed by the display system of the fourth preferred embodiment.

As shown in FIG. 11, at a start of the display format processing routine, the CPU 26 at step S31 inputs an original document data that is received from the document data source 24. After the document data is inputted, the CPU 26 at step S32 detects the layout data from the document data. After the layout data is detected, the CPU 26 at step S33 identifies the text/image data elements through classification of the document data. After the text/image data elements are identified, the CPU 26 at step S34 detects the display specification data that is stored in the storage device 23.

35 The CPU 26 at step S35 reads out a maximum display resolution from the display specification data detected at the step S34. After the maximum display resolution is read out, the CPU at step S36 reads out a document font data from the text data elements obtained at the step S33. In the present embodiment, a fixed font

size list including a fixed font size of a displayed text data for a general-purpose display unit is predetermined. The CPU 26 at step S37 calculates an appropriate font size of the displayed text data through making reference to the fixed font size based on the maximum display resolution of the display unit 21 (obtained at the step S35) and the document font data (obtained at the step S36). It is unnecessary for the user to preset a desired font type in the calculation of an appropriate font size of the displayed text data.

After the font size of the displayed text data is calculated, the CPU 26 at step S38 calculates a display size that is appropriate for the text data elements to be readable on the screen of the display unit 21, based on the calculated font size (step S37). After the step S38 is performed, the CPU 26 at step S39 produces a processed document data that reflects the display size calculated at the step S38, and stores the resulting document data into the storage device 23. Further, in the step S39, the CPU 26 receives the processed document data from the storage device 23, and supplies the processed document data to the display memory 22 in the display device 20, so that the document data is displayed on the display unit 21 in conformity with the display specification data and the layout data.

The display system of the above-described embodiment can provide the user with an appropriate font size of the displayed text data when viewing the document data displayed on the screen of the display unit 21.

FIG. 12 is a flowchart for explaining another display format processing routine executed by the display system of the fourth preferred embodiment.

As shown in FIG. 12, at a start of the display format processing routine, the CPU 26 at step S41 inputs an original document data that is received from the document data source 24. After the document data is inputted, the CPU 26 at step S42 detects the layout data from the document data. After the layout data is detected, the CPU 26 at step S43 identifies the text/image data elements through classification of the document data. After the text/image data elements are identified, the CPU 26 at step S44 detects the display specification data that is stored in the storage

device 23.

The CPU 26 at step S45 reads out a maximum display resolution from the display specification data detected at the step S44. After the maximum display resolution is read out, the CPU at
5 step S46 reads out a document font data from the text data elements obtained at the step S43. In the present embodiment, the user is allowed to input, from the operation unit 27, a user's choice for a document font size that is appropriate to make the displayed text data readable to the user, to the CPU 26. The CPU 26 at step S47
10 detects the user's document font choice that is inputted from the operation unit 27. The CPU 26 at step S48 changes the document font size to a display font size for enlargement according to the user's document font choice. The CPU 26 at step S49 calculates an appropriate font size of the displayed text data based on the display
15 font size obtained at the step S48.

After the appropriate font size of the displayed text data is calculated, the CPU 26 at step S50 calculates a display size that is appropriate for the text data elements to be readable on the screen of the display unit 21, based on the calculated font size (step S49).
20 After the step S50 is performed, the CPU 26 at step S51 produces a processed document data that reflects the display size calculated at the step S50, and stores the resulting document data into the storage device 23. Further, in the step S51, the CPU 26 receives the processed document data from the storage device 23, and
25 supplies the processed document data to the display memory 22 in the display device 20, so that the document data is displayed on the display unit 21 in conformity with the display specification data and the layout data.

The display system of the above-described embodiment can
30 provide the user with an appropriate font size of the displayed text data when viewing the document data displayed on the screen of the display unit 21. The user can input a desired document font size that is appropriate to make the displayed text data readable, from the operation unit 27 to the CPU 26.

35 FIG. 13 shows a display screen switching of a fifth preferred embodiment of the display system of the invention in which transparent images are set for data elements of a document data.

In the display system of the present embodiment, the display unit 21 is configured to include a touch panel screen, and transparent images corresponding to the text data elements of a document data on the touch panel screen are set. As shown in FIG. 13, rectangular areas corresponding to the text data elements "A", "B" and "C" of the document data on the touch panel screen of the display unit 21 are designated as the transparent images. When one of the transparent images on the touch panel screen of the display unit 21 is touched by the user, the displaying of the document data is switched to the enlarged view of the selected text data element as shown on the right side of one of FIG. 7, FIG. 8 and FIG. 9.

FIG. 14 is a flowchart for explaining a text data paragraph setting routine executed by a sixth preferred embodiment of the display system of the invention.

In the present embodiment, the elements of the display system are essentially the same as the corresponding elements of the display system 101 shown in FIG. 6, and a description thereof will be omitted. The text data paragraph setting routine of FIG. 14 is constituted by program code instructions stored in a memory of the CPU 26 or the storage device 23. In the present embodiment, the memory of the CPU 26 or the storage device 23 corresponds to a computer readable medium. Alternatively, other types of computer usable devices and media may be used as a computer readable medium. Further, in the display system 101 of the present embodiment, the program code instructions, stored in the memory of the CPU 26 or the storage device 23 (the computer readable medium), cause the CPU 26 to execute the text data paragraph setting routine of FIG. 14.

As shown in FIG. 14, at a start of the text data paragraph setting routine, the CPU 26 at step S61 inputs an original document data that is received from the document data source 24. After the document data is inputted, the CPU 26 at step S62 detects the layout data from the document data. After the layout data is detected, the CPU 26 at step S63 identifies the text/image data elements through classification of the document data. After the text/image data elements are identified, the CPU 26 at step S64 detects individual indent key inputs of a selected one of the text

data elements of the document data. The selection of the text data element from the document data may be made according to the user's demand. With respect to each of the indent key inputs detected at the step S64, the CPU 26 at step S65 performs paragraph setting of the selected text data element.

After the step S65 is performed, the CPU 26 at step S66 detects the display specification data that is stored in the storage device 23. The CPU 26 at step S67 calculates a display size that is appropriate for the text data elements to be readable on the screen of the display unit 21, based on the display specification data (obtained at the step S66) and the text data elements (obtained at the step S63). After the step S67 is performed, the CPU 26 at step S68 produces a processed document data that reflects the display size calculated at the step S67, and stores the resulting document data into the storage device 23. Further, in the step S68, the CPU 26 receives the processed document data from the storage device 23, and supplies the processed document data to the display memory 22 in the display device 20, so that the document data is displayed on the display unit 21 in conformity with the display specification data and the layout data.

FIG. 15 is a diagram for explaining the text data paragraph setting routine of the sixth preferred embodiment. As shown in FIG. 15, in the steps S61 through S63 of the routine of FIG. 14, the CPU 26 detects the layout data (L/D) from the document data, and identifies the respective text/image data elements of the document data from the detected layout data. Suppose that, in the example of FIG. 15, the document data includes the text data elements (T/D) "A" through "C" and the image data elements (I/D) "a" and "c". In the step S63, the CPU 26 separates the image data elements "a" and "c" from the text data elements "A" through "C". In the present embodiment, the CPU 26 takes no action for the image data elements "a" and "c".

Suppose that, in the example of FIG. 15, the text data element "A" is selected by the user from among the text data elements "A" through "C". With respect to the selected one of the text data elements "A" through "C", the CPU 26 performs the steps S64 and S65. The CPU 26 at the step S64 detects individual indent

key inputs of the selected text data element "A". With respect to each of the indent key inputs detected at the step S64, the CPU 26 at the step S65 performs paragraph setting of the selected text data element "A". In the example of FIG. 15, the text data element "A" is separated into two paragraphs "PARA1" and "PARA2".

After the step S65 is performed, the CPU 26 at the step S66 detects the display specification data that is stored in the storage device 23. The CPU 26 at the step S67 calculates the display size that is appropriate for the text data elements to be readable on the screen of the display unit 21. After the step S67 is performed, the CPU 26 at the step S68 controls the display device 20 so that the document data is displayed on the display unit 21 in conformity with the display specification data and the layout data. In the example of FIG. 15, the two paragraphs of the text data element "A" are separately displayed on the display unit 32.

In the display system of the above-described embodiment, when the text data element is too large in size to be displayed on the screen of the display unit 21, it can provide the user with an appropriate paragraph setting and an appropriate display size of the displayed text data when viewing it on the screen of the display unit 21.

FIG. 16 shows a data element layer display control processing of a seventh preferred embodiment of the display system of the invention.

In the present embodiment, the CPU 26 controls the display unit 21 such that an image of at least one of the data elements of a document data with a calculated display size, overlapped over a background image of the entire document data with an original display size, is displayed on the display unit 21. Further, the CPU 26 selects one of the data elements, which is displayed with the calculated display size on the display unit 21, in response to the user's demand, so that an image of the selected one of the data elements, overlapped over the background image of the entire document data with the original display size, appears with the calculated display size on the display unit 21.

As shown in FIG. 16, in a display example on the left side, the text data element "A" is selected according to the user's

demand, and the CPU 26 controls the display unit 21 such that an image ("TEXT PART A") of the selected text data element "A", overlapped over the background image of the entire document data with the original display size, appears with the calculated display size on the display unit 21. In a display example in the middle, the text data element "B" is selected according to the user's demand, and the CPU 26 controls the display unit 21 such that an image ("TEXT PART B") of the selected text data element "B", overlapped over the background image of the entire document data with the original display size, appears with the calculated display size on the display unit 21. In a display example on the right side, the text data element "C" is selected according to the user's demand, and the CPU 26 controls the display unit 21 such that an image ("TEXT PART C") of the selected text data element "C", overlapped over the background image of the entire document data with the original display size, appears with the calculated display size on the display unit 21.

In the above-described embodiment, the user can select arbitrary one of the data elements of the document data, which is displayed with the calculated display size on the display unit 21. Therefore, the display system and the display control method of the present embodiment are effective in improving the document displaying capabilities.

FIG. 17 shows another data element layer display control processing of the display system of the seventh preferred embodiment.

Similar to the embodiment of FIG. 16, in the present embodiment, the CPU 26 controls the display unit 21 such that an image of at least one of the data elements of a document data with a calculated display size, overlapped over a background image of the entire document data with an original display size, is displayed on the display unit 21. Further, the CPU 26 selects one of the data elements, which is displayed with the calculated display size on the display unit 21, in response to the user's demand, so that an image of the selected one of the data elements, overlapped over the background image of the entire document data with the original display size, appears with the calculated display size on the display

unit 21.

As shown in FIG. 17, in a display example on the top, a background image of the entire document data with an original display size is displayed on the display unit 21. In a display example on the bottom, the text data elements "A", "B" and "C" are selected according to the user's demand, and the CPU 26 controls the display unit 21 such that respective images of the selected text data elements "A" through "C", overlapped over the background image of the entire document data with the original display size, appear at a time with the calculated display size on the display unit 21.

In the above-described embodiment, the user can select all of the data elements of the document data, which are displayed at a time with the calculated display size on the display unit 21. Therefore, the display system and the display control method of the present embodiment are effective in improving the document displaying capabilities.

The present invention is not limited to the above-described embodiments, and variations and modifications may be made without departing from the scope of the present invention.

Further, the present invention is based on Japanese priority application No.11-363103, filed on December 21, 1999, the entire contents of which are hereby incorporated by reference.